

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the present application.

1. (Currently Amended) A high strength and high toughness magnesium alloy casting product containing “a” atomic% of Zn, “b” atomic% of Y and a residue of Mg, wherein “a” and “b” satisfy the following expressions (1) to (3), wherein said casting product has a long period stacking ordered structure phase:

(1) $0.5 \leq a < 5.0$;

(2) $0.5 < b < 5.0$; and

(3) $2/3a - 5/6 \leq b$.

2. (Currently Amended) A high strength and high toughness magnesium alloy according to claim 1 comprising a plastically worked product which has a hcp structured magnesium phase and is produced by subjecting ~~a magnesium alloy~~ said casting product to a plastic working.

3. (Original) A high strength and high toughness magnesium alloy comprising a plastically worked product which is produced by preparing a magnesium alloy casting product comprising “a” atomic% of Zn, “b” atomic% of Y and a residue of Mg, wherein “a” and “b” satisfy the following expressions (1) to (3), and then subjecting said magnesium alloy casting product to a plastic working, wherein said plastically worked product has a hcp structured magnesium phase and a long period stacking ordered structure phase at room temperature:

(1) $0.5 \leq a < 5.0$;

(2) $0.5 < b < 5.0$; and

(3) $2/3a - 5/6 \leq b$.

4. (Original) A high strength and high toughness magnesium alloy comprising a plastically worked product which is produced by preparing a magnesium alloy casting product comprising "a" atomic% of Zn, "b" atomic% of Y and a residue of Mg, wherein "a" and "b" satisfy the following expressions (1) to (3), and then subjecting said magnesium alloy casting product to a plastic working and a heat treatment, wherein said plastically worked product has a hcp structured magnesium phase and a long period stacking ordered structure phase at room temperature:

(1) $0.5 \leq a < 5.0$;

(2) $0.5 < b < 5.0$; and

(3) $2/3a - 5/6 \leq b$.

5. (Original) A high strength and high toughness magnesium alloy according to any one of claims 2 to 4, wherein said hcp structured magnesium phase has an average particle size of $2\mu\text{m}$ or more.

6. (Previously Presented) A high strength and high toughness magnesium alloy according to claim 3 or 4, wherein said long period stacking ordered structure phase has at least single-digit smaller dislocation density than said hcp structured magnesium phase.

7. (Previously Presented) A high strength and high toughness magnesium alloy according to claim 3 or 4, wherein said long period stacking ordered structure phase has a crystal grain having a volume fraction of 5% or more.

8. (Withdrawn) A high strength and high toughness magnesium alloy according to claim 3 or 4, wherein the plastically worked product contains at least one kind of precipitation selected from the group consisting of a compound of Mg and rare-earth element, a compound of Mg and Zn, a compound of Zn and rare-earth element and a compound of Mg, Zn and rare-earth element.

9. (Withdrawn) A high strength and high toughness magnesium alloy according to claim 8, wherein the at least one kind of precipitation has a total volume fraction of higher than 0 to 40% or less.

10. (Previously Presented) A high strength and high toughness magnesium alloy according to claim 3 or 4, wherein said plastic working is carried out by at least one process in a rolling, an extrusion, an ECAE working, a drawing, a forging, a press, a form rolling, a bending, a FSW working and a cyclic working of these workings.

11. (Previously Presented) A high strength and high toughness magnesium alloy according to claim 3 or 4, wherein a total strain amount when said plastic working is carried out is 15 and below.

12. (Previously Presented) A high strength and high toughness magnesium alloy according to claim 3 or 4, wherein a total strain amount when the plastic working is carried out is 10 and below.

13. (Withdrawn) A high strength and high toughness magnesium alloy according to any one of claims 1, 3 or 4, wherein Mg contains "c" atomic%, in a total amount, of at least one element selected from the group consisting of Yb, Tb, Sm and Nd, wherein "c" satisfies the following expressions (4) and (5),

(4) $0 \leq c \leq 3.0$ and

(5) $0.2 \leq b+c \leq 6.0$.

14. (Withdrawn) A high strength and high toughness magnesium alloy according to any one of claims 1, 3 or 4, wherein Mg contains "c" atomic%, in a total amount, of at least one element selected from the group consisting of La, Ce, Pr, Eu, Mm and Gd, wherein "c" satisfies the following expressions (4) and (5) or (5) and (6):

(4) $0 \leq c < 2.0$;

(5) $0.2 \leq b+c \leq 6.0$; and

(6) $c/b \leq 1.5$.

15. (Withdrawn) A high strength and high toughness magnesium alloy according to any one of claims 1, 3 or 4, wherein Mg contains “c” atomic%, in a total amount, of at least one element selected from the group consisting of Yb, Tb, Sm and Nd and “d” atomic%, in a total amount, of at least one element selected from the group consisting of La, Ce, Pr, Eu, Mm and Gd, wherein “c” and “d” satisfy the following expressions (4) to (6) or (6) and (7):

(4) $0 \leq c \leq 3.0$;

(5) $0 \leq d < 2.0$;

(6) $0.2 \leq b+c+d \leq 6.0$; and

(7) $d/b \leq 1.5$.

16. (Withdrawn) A high strength and high toughness magnesium alloy comprising “a” atomic% of Zn, “b” atomic% of Y and a residue of Mg, wherein “a” and “b” satisfy the following expressions (1) to (3):

(1) $0.25 \leq a \leq 5.0$;

(2) $0.5 \leq b \leq 0.5$; and

(3) $0.5a \leq b$.

17. (Withdrawn) A high strength and high toughness magnesium alloy according to claim 16 comprising a plastically worked product which has a hcp structured magnesium phase and is produced by cutting a magnesium alloy casting product and then subjecting said magnesium alloy casting product to a plastic working.

18. (Withdrawn) A high strength and high toughness magnesium alloy comprising a plastically worked product which is produced by preparing a magnesium alloy casting product comprising “a” atomic% of Zn, “b” atomic% of Y and a residue of Mg, wherein “a” and “b” satisfy the following expressions (1) to (3), then cutting said magnesium alloy casting product to form a chip-shaped casting product and then solidifying said ship-shaped casting product by a plastic working, wherein said plastically worked product has a hcp structured magnesium phase and a long period stacking ordered structure phase at room temperature:

(1) $0.25 \leq a \leq 5.0$;

(2) $0.5 \leq b \leq 5.0$; and

(3) $0.5a \leq b$.

19. (Withdrawn) A high strength and high toughness magnesium alloy comprising a plastically worked product which is produced by preparing a magnesium alloy casting product comprising “a” atomic% of Zn, “b” atomic% of Y and a residue of Mg, wherein “a” and “b” satisfy the following expressions (1) to (3), then cutting said magnesium alloy casting product to form a chip-shaped casting product, solidifying said chip-shaped casting product by a plastic working to form said plastically worked product and then subjecting said plastically worked product to a heat treatment, wherein said plastically worked product after subjecting to said heat treatment has a hcp structured magnesium phase and a long period stacking ordered structure phase at room temperature:

(1) $0.25 \leq a \leq 5.0$;

(2) $0.5 \leq b \leq 5.0$; and

(3) $0.5a \leq b$.

20. (Withdrawn) A high strength and high toughness magnesium alloy according to any one of claims 17 to 19, wherein said hcp structured magnesium phase has an average particle size of $0.1\mu\text{m}$ or more.

21. (Withdrawn) A high strength and high toughness magnesium alloy according to claim 18 or 19, wherein said long period stacking ordered structure phase preferably has at least single-digit smaller dislocation density than said hcp structured magnesium phase.
22. (Withdrawn) A high strength and high toughness magnesium alloy according to claim 18 or 19, wherein said long period stacking ordered structure phase has a crystal grain having a volume fraction of 5% or more.
23. (Withdrawn) A high strength and high toughness magnesium alloy according to claim 18 or 19, wherein said plastically worked product contains at least one kind of precipitation selected from the group consisting of a compound of Mg and rare-earth element, a compound of Mg and Zn, a compound of Zn and rare-earth element and a compound of Mg, Zn and rare-earth element.
24. (Withdrawn) A high strength and high toughness magnesium alloy according to claim 23, wherein said at least one kind of precipitation has a total volume fraction of higher than 0 to 40% or less.
25. (Withdrawn) A high strength and high toughness magnesium alloy according to claim 18 or 19, wherein said plastic working is carried out by at least one process in a rolling, an extrusion, a ECAE working, a drawing, a forging, a press, a form rolling, a bending, a FSW working and a cyclic working of theses workings.
26. (Withdrawn) A high strength and high toughness magnesium alloy according to claim 18 or 19, wherein a total strain amount when said plastic working is carried out is 15 and below.
27. (Withdrawn) A high strength and high toughness magnesium alloy according to claim 18 or 19, wherein a total strain amount when said plastic working is carried out is 10 and below.

28. (Withdrawn) A high strength and high toughness magnesium alloy according to any one of claims 16, 18 or 19, wherein Mg contains "c" atomic%, in a total amount, of at least one element selected from the group consisting of Yb, Tb, Sm and Nd, wherein "c" satisfies the following expressions (4) and (5):

(4) $0 \leq c \leq 3.0$; and

(5) $0.1 \leq b+c \leq 6.0$.

29. (Withdrawn) A high strength and high toughness magnesium alloy according to any one of claims 16, 18 or 19, wherein Mg contains "c" atomic%, in a total amount, of at least one element selected from the group consisting of La, Ce, Pr, Eu, Mm and Gd, wherein "c" satisfies the following expressions (4) and (5):

(4) $0 \leq c \leq 3.0$; and

(5) $0.1 \leq b+c \leq 6.0$.

30. (Withdrawn) A high strength and high toughness magnesium alloy according to any one of claims 16, 18 or 19, wherein Mg contains "c" atomic%, in a total amount, of at least one element selected from the group consisting of Yb, Tb, Sm and Nd and "d" atomic%, in a total amount, of at least one element selected from the group consisting of La, Ce, Pr, Eu, Mm and Gd, wherein "c" and "d" satisfy the following expressions (4) to (6):

(4) $0 \leq c \leq 3.0$;

(5) $0 \leq d \leq 3.0$; and

(6) $0.1 \leq b+c+d \leq 6.0$.

31. (Currently Amended) A high strength and high toughness magnesium alloy according to any one of claims 1, 3[[,]] or 4, ~~16, 18 or 19~~, wherein Mg contains larger than 0 to 2.5 atomic% or less, in a total amount, of at least one element selected from the group consisting of Al, Th, Ca, Si, Mn, Zr, Ti, Hf, Nb, Ag, Sr, Sc, B, C, Sn, Au, Ba, Ge, Bi, Ga, In, Ir, Li, Pd, Sb and V.

32. (Withdrawn) A method of producing a high strength and high toughness magnesium alloy comprising:

a step for preparing a magnesium alloy casting product comprising “a” atomic% of Zn, “b” atomic% of Y and a residue of Mg, wherein “a” and “b” satisfy the following expressions (1) to (3), and

a step for producing a plastically worked product by subjecting said magnesium alloy casting product to a plastic working:

(1) $0.5 \leq a < 5.0$;

(2) $0.5 < b < 5.0$; and

(3) $2/3a - 5/6 \leq b$.

33. (Withdrawn) A method of producing a high strength and high toughness magnesium alloy according to claim 32, wherein said magnesium alloy casting product has a hcp structured magnesium phase and a long period stacking ordered structure phase.

34. (Withdrawn) A method of producing a high strength and high toughness magnesium alloy according to claim 32 or claim 33, wherein Mg contains “c” atomic%, in a total amount, of at least one element selected from the group consisting of Yb, Tb, Sm and Nd, wherein “c” satisfies the following expressions (4) and (5):

(4) $0 \leq c \leq 3.0$; and

(5) $0.2 \leq b + c \leq 6.0$.

35. (Withdrawn) A method of producing a high strength and high toughness magnesium alloy according to claim 32 or claim 33, wherein Mg contains “c” atomic%, in a total amount, of at least one element selected from the group consisting of La, Ce, Pr, Eu, Mm and Gd, wherein “c” satisfies the following expressions (4) and (5) or (5) and (6):

(4) $0 \leq c < 2.0$;

(5) $0.2 \leq b+c \leq 6.0$; and

(6) $c/b \leq 1.5$.

36. (Withdrawn) A method of producing a high strength and high toughness magnesium alloy according to claim 32 or claim 33, wherein Mg contains “c” atomic%, in a total amount, of at least one element selected from the group consisting of Yb, Tb, Sm and Nd and “d” atomic%, in a total amount, of at least one element selected from the group consisting of La, Ce, Pr, Eu, Mm and Gd, wherein “c” and “d” satisfy the following expressions (4) to (6) or (6) and (7):

(4) $0 \leq c \leq 3.0$;

(5) $0 \leq d < 2.0$;

(6) $0.2 \leq b+c+d \leq 6.0$; and

(7) $d/b \leq 1.5$.

37. (Withdrawn) A method of producing a high strength and high toughness magnesium alloy comprising:

a step for preparing a magnesium alloy casting product containing “a” atomic% of Zn, “b” atomic% of Y and a residue of Mg, wherein “a” and “b” satisfy the following expressions (1) to (3);

a step for producing a chip-shaped casting product by cutting said magnesium alloy casting product; and

a step for producing a plastically worked product by subjecting said chip-shaped casting product to a plastic working:

(1) $0.25 \leq a \leq 5.0$;

(2) $0.5 \leq b \leq 5.0$; and

(3) $0.5a \leq b$.

38. (Withdrawn) A method of producing a high strength and high toughness magnesium alloy according to claim 37, wherein said magnesium alloy casting product has a hcp structured magnesium phase and a long period stacking ordered structure phase.

39. (Withdrawn) A method of producing a high strength and high toughness magnesium alloy according to claim 37 or claim 38, wherein Mg contains "c" atomic%, in a total amount, of at least one element selected from the group consisting of Yb, Tb, Sm and Nd, wherein "c" satisfies the following expressions (4) and (5):

(4) $0 \leq c \leq 3.0$; and

(5) $0.1 \leq b+c \leq 6.0$.

40. (Withdrawn) A method of producing a high strength and high toughness magnesium alloy according to claim 37 or claim 38, wherein Mg contains "c" atomic%, in a total amount, of at least one element selected from the group consisting of La, Ce, Pr, Eu, Mm and Gd, wherein "c" satisfies the following expressions (4) and (5):

(4) $0 \leq c \leq 3.0$; and

(5) $0.1 \leq b+c \leq 6.0$.

41. (Withdrawn) A method of producing a high strength and high toughness magnesium alloy according to claim 37 or claim 38, wherein Mg contains "c" atomic%, in a total amount, of at least one element selected from the group consisting of Yb, Tb, Sm and Nd and "d" atomic%, in a total amount, of at least one element selected from the group consisting of La, Ce, Pr, Eu, Mm and Gd, wherein "c" and "d" satisfy the following expressions (4) to (6):

(4) $0 \leq c \leq 3.0$;

(5) $0 \leq d \leq 3.0$; and

(6) $0.1 \leq b+c+d \leq 6.0$.

42. (Withdrawn) A method of producing a high strength and high toughness magnesium alloy according to claim 32 or 37, wherein Mg contains larger than 0 atomic% to 2.5 atomic% or less, in a total amount, of at least one element selected from the group consisting of Al, Th, Ca, Si, Mn, Zr, Ti, Hf, Nb, Ag, Sr, Sc, B, C, Sn, Au, Ba, Ge, Bi, Ga, In, Ir, Li, Pd, Sb and V.

43. (Withdrawn) A method of producing a the high strength and high toughness magnesium alloy according to claim 32 or 37, wherein said plastic working is carried out by at least one process in a rolling, a extrusion, a ECAE working, a drawing, a forging, a press, a form rolling, a bending, a FSW working and a cyclic working of theses workings.

44. (Withdrawn) A method of producing a high strength and high toughness magnesium alloy according to claim 32 or 37, wherein a total strain amount when said plastic working is carried out is 15 and below.

45. (Withdrawn) A method of producing a high strength and high toughness magnesium alloy according to claim 32 or 37, wherein a total strain amount when said plastic working is carried out is 10 and below.

46. (Withdrawn) A method of producing a high strength and high toughness magnesium alloy according to claim 32 or 37 further comprising a step for heat-treating said plastically worked product after said step for producing said plastically worked product.

47. (Withdrawn) A method of producing a high strength and high toughness magnesium alloy according to claim 46, wherein said heat treatment is carried out under a condition of a temperature of 200°C to lower than 500°C and a treating period of 10 minutes to shorter than 24 hours.

48. (Withdrawn) A method of producing a high strength and high toughness magnesium alloy according to claim 32 or 37, wherein said magnesium alloy after subjecting to said plastic working has a hcp structured phase preferably having at least single-digit larger dislocation density than a long period stacking ordered structure magnesium phase.